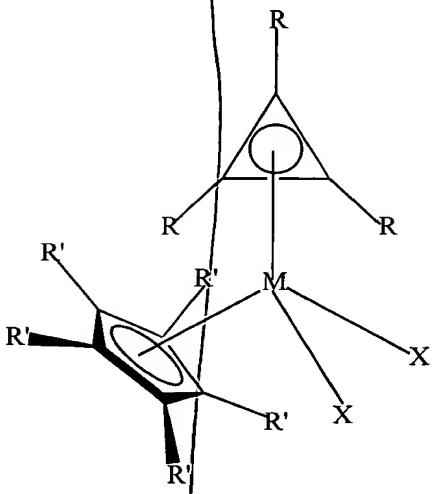
CLAIMS

1. An olefin polymerization catalyst comprising a cationic complex that results from exposure of a neutral transition metal compound to an activator composition wherein the neutral transition metal compound may be represented by the following formula:

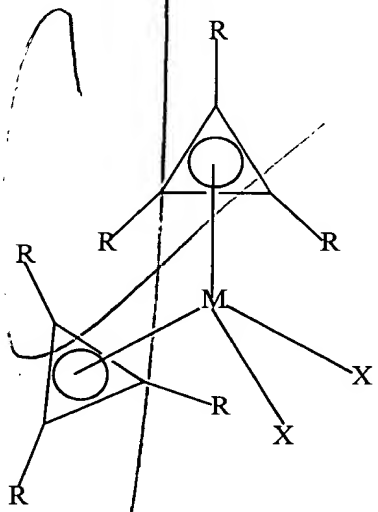
$$(C_3R_3)_mMX_n$$

wherein $(C_3R_3)$is a cyclopropenyl ring and each R is a monodentate or a bidentate radical and is independently hydrogen, hydrocarbyl, substituted-hydrocarbyl, halocarbyl, substituted-halocarbyl, hydrocarbyl-substituted organometalloid, halocarbyl-substituted organometalloid, disubstituted boron, disubstituted pnictogen, substituted chalcogen or halogen, and when R is a bidentate radical it may form a C_4 to C_{20} ring system to give a saturated or unsaturated polycyclic cyclopropenyl ligand or it may form a bridge between one (C_3R_3) and another (C_3R_3) or an X radical; each X radical is independently a halide, hydride , hydrocarbyl, substituted hydrocarbyl, halocarbyl, substituted halocarbyl, and hydrocarbyl- and halocarbyl-substituted organometalloid, substituted pnictogen, or substituted chalcogen and one X may be a pi-bonded cyclopentadienyl or a cyclopentadienyl-derived ligand and one X may be an amido or an imido radical; M is a Group 3, 4, 5, 6, 8, or 10 transition metal, and m and n are integers of 1 or greater and m+n satisfies the valence of M.

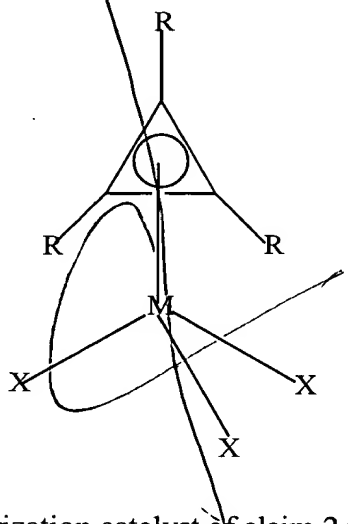
2. The olefin polymerization catalyst of claim 1 wherein the neutral transition metal compound may be represented by the following formula:



3. The olefin polymerization catalyst of claim 1 wherein the neutral transition metal compound may be represented by the following formula:



4. The olefin polymerization catalyst of claim 1 wherein the neutral transition metal compound may be represented by the following formula:



5. The olefin polymerization catalyst of claim 2 wherein M a group 6 metal.

6. The olefin polymerization catalyst of claim 5 wherein M chromium.

7. The olefin polymerization catalyst of claim 5 wherein M molybdenum.

8. The olefin polymerization catalyst of claim 7 wherein the neutral transition metal compound is cyclopropenyl cyclopentadienyl molybdenum dichloride.

9. The olefin polymerization catalyst of claim 3 wherein M is group 8 metal.

10. The olefin polymerization catalyst of claim 9 wherein M is iron.

11. The olefin polymerization catalyst of claim 10 wherein the neutral transition metal compound is dicyclopropenyl iron dichloride.

12. The olefin polymerization catalyst of claim 4 wherein M is a group 10 metal.

13. The olefin polymerization catalyst of claim 12 wherein M is palladium.

14. The olefin polymerization catalyst of claim 13 wherein the neutral transition metal compound is cyclopropenyl palladium trichloride.

15. The olefin polymerization catalyst of claim 4 wherein M is a group 5 metal.

16. The olefin polymerization catalyst of claim 15 wherein M is vanadium.

17. The olefin polymerization catalyst of claim 16 wherein the neutral transition metal compound is cyclopropenyl alkylimido vanadium dichloride.

18. The olefin polymerization catalyst of claim 2 wherein M a group 4 metal.

19. The olefin polymerization catalyst of claim 18 wherein M is titanium.

20. The olefin polymerization catalyst of claim 19 wherein the neutral transition metal compound is cyclopropenyl cyclopentadienyl titanium dichloride.

21. The olefin polymerization catalyst of claim 18 wherein M is zirconium.

22. The olefin polymerization catalyst of claim 21 wherein the neutral transition metal compound is cyclopropenyl cyclopentadienyl zirconium dichloride.

23. The olefin polymerization catalyst of claim 18 wherein M is hafnium.

24. The olefin polymerization catalyst of claim 23 wherein the neutral transition metal compound is cyclopropenyl cyclopentadienyl hafnium dichloride.

25. The olefin polymerization catalyst of claim 2 wherein M is a group 3 metal.

26. The olefin polymerization catalyst of claim 25 wherein M is scandium.

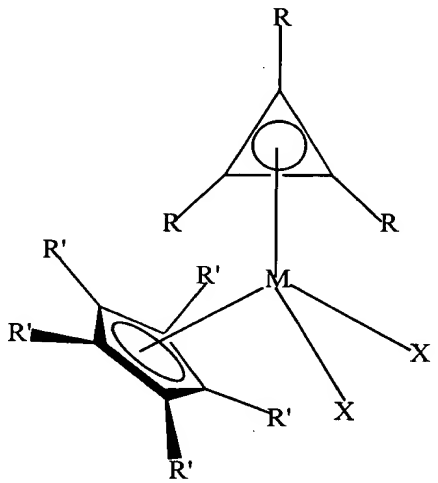
27. The olefin polymerization catalyst of claim 26 wherein the neutral transition metal compound is cyclopropenyl cyclopentadienyl scandium chloride.

28. A method of polymerizing olefins, comprising contacting one or more polymerizable olefins under polymerizing conditions with a polymerization catalyst comprising a cationic complex that results from exposure of a neutral transition metal compound to an activator composition wherein the neutral transition metal compound may be represented by the following formula:

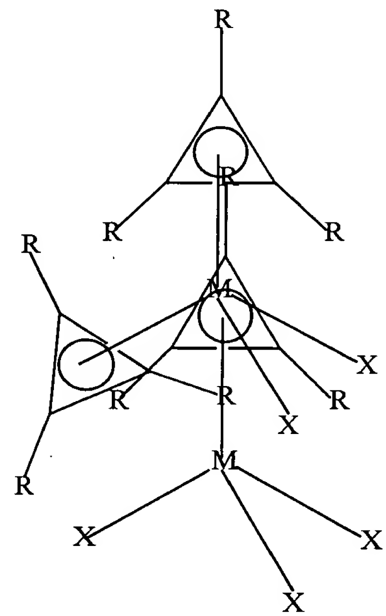
$$(C_3R_3)_mMX_n$$

wherein $(C_3R_3)$is a cyclopropenyl ring and each R is a monodentate or a bidentate radical and is independently hydrogen, hydrocarbyl, substituted-hydrocarbyl, halocarbyl, substituted-halocarbyl, hydrocarbyl-substituted organometalloid, halocarbyl-substituted organometalloid, disubstituted boron, disubstituted pnictogen, substituted chalcogen or halogen, and when R is a bidentate radical it may form a C_4 to C_{20} ring system to give a saturated or unsaturated polycyclic cyclopropenyl ligand or it may form a bridge between one (C3R3) and another (C3R3) or an X radical; each X radical is independently a halide, hydride , hydrocarbyl, substituted hydrocarbyl, halocarbyl, substituted halocarbyl, and hydrocarbyl- and halocarbyl-substituted organometalloid, substituted pnictogen, or substituted chalcogen and one X may be a pi-bonded cyclopentadienyl or a cyclopentadienyl-derived ligand and one X may be an amido or an imido radical; M is a Group 3, 4, 5, 6 8, or 10 transition metal, and m and n are integers of 1 or greater and m+n satisfies the valence of M.

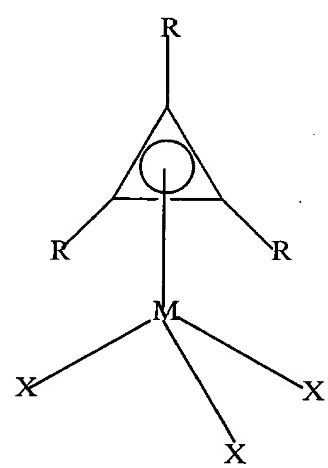
29. The method of polymerizing olefins of claim 28, wherein the neutral transition metal compound may be represented by the following formula:



30. The method of polymerizing olefins of claim 28, wherein the neutral transition metal compound may be represented by the following formula:



31. The method of polymerizing olefins of claim 28, wherein the neutral transition metal compound may be represented by the following formula:



32. A catalyst compound comprising one or more cyclopropenyl rings coordinated to a Group 3, 4, 5, 6, 8, or 10 transition metal.

33. The catalyst compound of claim 32 wherein the transition metal is in a neutral state containing 10 to 16 electrons derived from (n-1)d, (n)s and (n)p orbitals.